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ABSTRACT

Lifelong learning and skill flexibility are especially important for workers in China, where structural economic adjustment has generated 22 million layoffs from state-owned enterprises since 1997. Skills that were in huge demand in previous years, such as accounting, international trade, and language translation, are now facing serious oversupply pointing to the need for a workforce that is both highly educated and adaptable. On-the-job training, which is mostly informal and is usually carried out within a firm while the worker is still working, and off-the-job training, which takes more formal forms and is usually outside of the firm, are two activities that increase skills and employability. Using data collected from nearly 3500 urban Chinese residents aged 25-65, it was found that off-job training in previous firms significantly raises wages at current firms, while previous on-job training has no effect on current wages. However, after controlling for unobserved motivations and abilities, the training-wage relationship of both types of training became insignificant. Based upon results that have been found true in competitive labor markets around the world that suggest that training improves human capital and hence raises wages, it is recommended that the Chinese government direct resources to more general type of training rather than firm-specific training. (Contains 13 references and 7 tables.) (MO)

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General and Specific Human Capital: Policy Implications of Private Sector Training on China's Unemployment Problems

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New Orleans: LA

Abstract — Private-sector training consists of two types of human capital: general and firm specific. Based on specific human capital theories pioneered by Gary Becker, this paper empirically examined the impact of on-the-job training and off-the-job training on wage levels in the context of China. It was found that off-job training in previous firms significantly raises wages at current firm, while previous on-job training has no effect on current wages. The results are compatible with theory and are also comparable with US experience. However, after controlling for unobserved motivations and abilities using both the Heckman procedure and IV method, the training-wage relationship of both types became insignificant. Several possible explanations of the non-existence of training effect are discussed at the end of the paper.

Comments and suggestions are greatly appreciated. Please email me at zx20@columbia.edu

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I. Background

Structural economic adjustment in China since 1997 has generated 22 million laid-off workers from the state-owned enterprises, in addition to a huge agricultural population shifting to industry, many not fully-employed. In recent years, due to the rapid expansion of higher education at an annual rate of about 30%, unemployment among the young and educated population is also increasing, adding extra pressure to the labor market (Levin & Xu, 2003). As one of the attempts to ease the labor market tensions, the Chinese government recently stipulated a new policy advocating vocational training.

Even in the absence of unemployment pressure, the fast growing economy in the context of structural adjustment poses much higher requirements on labor qualities. Specifically, life-long learning becomes especially important at a time of rapid economic growth, which entails the need of more flexibility in skills to adapt to the constantly changing and largely unpredictable market. In a recent survey of skill demand and supply in major China cities in the last quarter of 2002, such skills as accounting, international trade and language translation that were in huge demand in previous years are now facing serious over supply. Labor market in China needs not just highly educated workforces, but also a workforce that is adaptable.

Training is an indispensable part of life long human accumulation. Although there are a lot of studies on the rate of return to formal schooling, there are relatively few empirical studies on the rate of return to training. There are mainly two types of trainings: off-the-job training and on-the-job training. In the context of China, on-the-job training is

mostly informal and is usually carried out within the firm while the worker is still working most of the time. Off-the-job training takes more formal forms and is usually outside of the firm. Trainee of this type still gets paid at the level of his basic wage during the training period. But he is no long entitled to bonus and subsidies, which stand for an important portion of a worker's total income. Due to the characteristics described above, it is legitimate to assume that on-the-job training is more closely related to specific firms, while off-the-job training is more general. Therefore, this paper regards on-the-job training as a manifestation of firm-specific human capital, while off-the-job general human capital.

This paper first reviewed some specific human capital theories. Those theories, as well as empirical observations, imply that firms are willing to share the cost of training of both types. Based on such ground, this paper next explored the hypothesis that, if training is profitable at all, the government should promote more general training rather than specific training. There are mainly two reasons. First, general skills and knowledge are more adaptable to new working positions and environments than firm-specific skills and knowledge. Second, as general training takes more formal forms like night schools, it is more likely that certificates are awarded after training. This fact is a great advantage to both sides of employment in that it can partially compensate for the negative impact resulting from asymmetric information.

With such hypotheses, the study empirically estimated the differential rates of return to both types of human capital. Such rates were captured by estimating the impacts of on-the-job training and off-the-job training in previous firms on current wage levels, together with the estimation of experience effect and tenure effect on current wages. Previous studies

in the US produced coefficients as predicted by the theory. That is, previous off-the-job training experience has significant positive on the wage level at current firm, while previous on-the-job training has no influence on current wages.

Even though China did not have a fully competitive labor market by the time when the survey was done, and hence wages could not fully capture individual's productivity, OLS estimation still found positive significant off-the-job training effect across different firms. Previous on-the-job training proves to be irrelevant to the current firm. At the same time, experience effect is found to be significantly positive while tenure effect is slightly yet significantly negative. All these OLS results have the predicted signs and are robust to various specifications. For instance, although regional income disparity is a notable phenomenon in China and the inclusion of region dummy variables doubled the R-square of the model, the training coefficients had no significant changes. The results are also robust to the inclusion of industrial sector dummy variables.

However, before making any policy conclusions, the above results were put under further scrutiny, mainly based on the observation that choice into training programs is not a random event. Some unobserved personal characteristics that drove people to get more training might also have influence on their wage levels. For instance, it might not be the case that more training leads to higher wages. Instead, it might be the case that more motivated and abler people choose to get more training, and it is such motivation and ability that also raised their wages. That is to say, training variables are endogenous. After controlling for such potential endogeneity using both Heckman's two-stage procedure as well as instrument variable method, training effects disappeared. Both statistical methods found such shifts in

training variable coefficients. This finding may prove that individual abilities and motivations are the real force driving up wages, and that the amount of training is just a manifestation of those latent factors. Such findings contradict what was found using the US data. There are, however, several possible explanations for the contradiction between theory and China data. Further discussions are included in section IV and also in the concluding section.

II. Specific Human Capital Theories

In his seminal work on human capital, Gary Becker (1962) proposed a formal economic model to describe earnings profile and its relation with on-the-job trainings. In his work, on-the-job training was used to generally refer to informal human capital accumulation while people are in the job market, as compared with formal schooling. Both formal schooling and job training are activities that can influence future well-being through the imbedding of resources in people. Although there are lots of empirical estimations on the rate of return to formal schooling, on-the-job training has often been underrated and relatively few empirical studies have been carried out on this topic. This lack of empirical results on the rate of return to training is largely due to the lack of qualified data as such estimations need information on various spells of jobs and trainings and information on the ways to match those spells of jobs and trainings (Lynch, 1992). As summarized in Lynch's study (1992), training questions asked in most of the surveys cannot elicit adequate information required for empirical research on training.

On the other hand, training theories have been explored further since Becker, most notably Hashimoto's study (1981) on cost sharing in training as an application of the Coarse

theorem, Katz and Ziderman's model of asymmetric information and firm offering of general training (1990), Barron and Black's theory of job matching and on-the-job training (1989), Black, Noel and Wang's study on the relationship between firm size and training opportunities (1999), and Weiss and Wang's hypothesis about using formal training as a method to elicit private information known by workers (1990). The rest of this section will discuss a general training model that focuses on the difference between specific human capital and general human capital accumulations.

Workers gain productivity by training in the private sector. Such improvement in productivity is partially realized by enhanced skills and knowledge specific to the current firm, and partially by enhanced skills and knowledge that are applicable in the general labor market. Therefore, the market values to specific skills and general skills are different for the current firms and the other firms. In the most extreme case, specific skills are valuable only to the current firm or sector and have no value to other firms or sectors. General skills, on the other hand, are equally valuable to all the firms in the market. Therefore, in order to materialize specific skills, trained workers are likely to stay in the current firm since they will get zero returns to such skills in other firms. By contrast, with general skills, workers such trained are indifferent between staying at the current firm or any other firms in the market.

Every improvement in productivity and in market values comes with a cost. Otherwise the demand for training would become infinite. In a competitive labor market the firms pay workers wages at their marginal products.

$$MP_t = W_t \qquad (1),$$

where *t* refers to the time period. In Becker's terms (1962), wages can also be regarded as marginal expenditures, and MP can be called marginal receipts from firm's perspective. Cost of training can take the form of lower current receipts and higher expenditures if training cost is shared between the worker and the firm. As long as in the future time periods the firm can generate receipts that are high enough to offset the low profitability during the training spells, training is profitable to the firm and it is willing to share training costs with the workers. In a competitive market, the equilibrium will be realized when the present values of receipts and expenditures equalize. More explicitly,

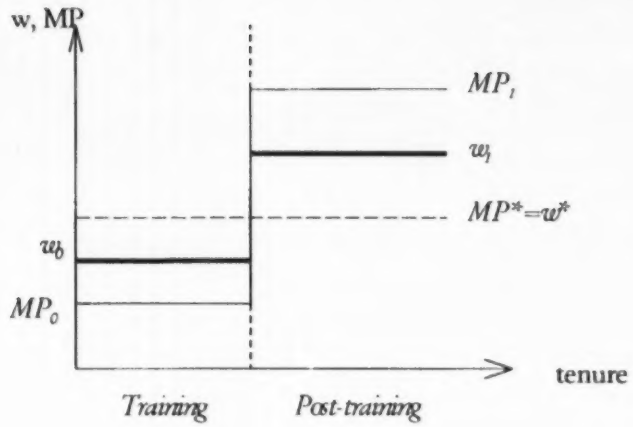
$$\sum_{t=0}^{n-1} \frac{MP_t}{(1+r)^{t+1}} = \sum_{t=0}^{n-1} \frac{W_t}{(1+r)^{t+1}} \quad (2),$$

where r is the discount rate. Cost sharing entails that during the training period, the firm pays a wage that is above the actual marginal productivity of the worker and it pays less than the actual MP of the worker in the post-training period. The productivity in the training period is lowered because of the opportunity cost of time spent in training. In a simplified two-period model, let t=0 be the training period and t=1 the post-training period. Let MP* be the value of the worker to the other firms in the market. Then,

$$MP_1 > MP^* \quad (3)$$
$$W_0 > MP_0; MP^* < W_1 < MP_1 \quad (4)$$
$$W_0 - MP_0 \leq MP_1 - W_1 \quad (5),$$

Cost sharing is sustainable only when (3), (4) and (5) are satisfied. First, marginal product to the current firm after training should be larger than the marginal product to the other firms in the market. If MP1 is smaller than even the market value, then the training is counterproductive. If MP1 is the same as the market marginal product, then the workers are indifferent between staying and leaving. In this case, since the current firm has shared the training cost in the initial period, whether such investment will generate profit is subject to the worker's random choice. Therefore, the firm is not willing to share the training cost in the first period. Only when the worker's productivity is higher at the current firm than in any other firms will the worker choose to stay and the firm has the possibility of recovering its initial investment. Second, cost sharing becomes sustainable only when (4) and (5) are satisfied. The firm is willing to overpay the worker in the training period just because it can underpay him in the post-training period. And the amount of underpayment should be at least as large as the overpaid amount in the training period. Finally, W1 should not be lower than the market value of the worker. If so, the worker is going to leave.

The only training scheme that can satisfy cost-sharing conditions is to train such skills that are very useful to the current firm/sector but have no value outside the firm/sector. This implies that firm is more willing to invest in firm-specific human capitals than in general human capitals. Such a cost-sharing scheme becomes clearer if we consider a stylized firm that only offers specific human capital training in the following graph.



MP* is the market value of the worker and can be considered as the stock of general human capital embedded in him. The market pays him w*=MP*. Suppose the worker starts training and if the training is completely general, due the opportunity cost of time, his marginal product in the training period is reduced to MP_0. The firm pays in accordance with this level of productivity. However, if the training is purely firm specific, the firm pays w0 that is higher than MP_0. The over-paid portion is firm investment, and the difference between w* and w_0 is worker investment.

In the post-training period, general human capital does not change at MP* while specific human capital increases to MP_1. However, the firm does not have to pay MP_1 to the worker. Instead, it can pay anything between w* and MP_1 because the increased productivity is only valuable to the firm. If the worker quits, he can only get w*. As long as $w_1 > w^*$, the worker has no incentives to quit. Therefore, MP_1-w_1 is the training returns to the firm, and w_1-w* is the training returns to the worker. As shown in the graph, with general training the

worker is going to be paid according to his marginal product. So the wage profile for workers with more general trainings is steeper than those with more specific trainings.

A natural implication of the above framework is that firm has no incentives to provide general trainings. As Becker (1962) pointed out, firms would provide general training only if they did not have to pay any of the costs. However, later empirical observations and theories found that firms also sponsor general training. Katz and Ziderman (1990) added asymmetric information between workers and new firms into the model. They argue that the value of training consists of two parts. In the past people only focused on the first component: the net present value of training. A second very important component is the options the training provides in the face of random shocks and changes. This component is termed options value of training. For instance, some training provides better basis for further advanced training, makes it easier to adopt new technologies and allows workers to take on different tasks when emergency arises. Katz and Ziderman's theory pointed out that the value of a worker to a firm is an increasing function of the information it has about the worker's general training. Such informational asymmetry is particularly pronounced and intractable for the option values of training. The transaction cost of finding out the real value of a worker to a new firm justifies cost sharing even for training in general skills.

III. Empirical Strategies

Specific human capital theory has several implications that can be tested empirically. First, it is expected that more general training is more easily portable across firms. Therefore,

previous general training experiences may have positive impact on current wages. On the other hand, since specific training is less portable, it has less value to the current firm and therefore is expected to have no effect on current wages. In addition, general training and specific training within the current job spell may have negative influence, if there is any, on the current wage rate as a result of cost sharing. Most of these predicted effects prove to be correct empirically by Lynch (1992) using NLSY data for US workers.

Besides examining current and previous trainings, labor market experience and tenure at the current job may relate differently to the current wage. Total labor market experience embodies both general skills and specific skills, while tenure mainly stands for skill level specific to the current firm. Previous empirical research tends to find minor tenure effect after adjusting for unobserved factors in various ways (Abraham and Farber, 1987; Altonji and Shakotko, 1987; Marshall and Zarkin, 1987). However, Topel (1991) in a later study found that 10 years of current job seniority raise the wage of the typical male worker in the United States by over 25 percent. Lynch (1992) also found significant positive tenure effect. The tenure effect, therefore, might be mixed empirically: It can be positive if the hypothesis that abler people tend to stay longer is true. The effect can also be negative if the reason for people to stay at one place longer is that they cannot find better jobs elsewhere.

In this paper, a log-linear functional form is specified for estimation. The dependent variable is the log wages in 1994. It is specified as a function of formal schooling (S), labor market experience (E), current job tenure (T), a vector of training variables (**X**), personal characteristics (**P**) and family background variables (**FBK**).

$$\ln(w) = b_0 + b_1 S + b_2 E + b_3 T + \mathbf{X}'\boldsymbol{\gamma} + \mathbf{P}'\boldsymbol{\delta} + \mathbf{FBK}'\boldsymbol{\zeta} + e \qquad (6),$$

However, as introduced in the background section, OLS estimator for equation (6) may be biased due to the possibility that unobserved characteristics may influence both the wage and the amount of training a person chooses to have. For instance, people who have more training may be more motivated and abler, and motivation and ability will also lead to higher wages. Therefore, **X** might be endogenous. There are three possible strategies to deal with this problem. First, a standard Heckman two-stage procedure (Heckman, 1979) can be applied to the estimation. The first stage predicts the probability of getting training based on a series of observed individual features. The results of the first stage are then used to construct the inverse of Mill's ratio, which is added into the second stage wage equation as an observed variable. This procedure essentially equals treating endogeneity as a missing variable problem. By "recovering" the missing variables OLS estimator generates unbiased estimates.

The second way to solve endogeneity is to use instrument variables. Instruments affect training decisions but have no effect on wage levels. 2SLS estimator is then unbiased because the instrumenting procedure "purifies" the portion of variance in **X** that is correlated with error. The third method to get unbiased estimates is a fixed effect model by taking advantage of panel data. Focus on X and simplify equation (6) as the following:

$$\ln(w_{it}) = \mathbf{X}'_{it}\boldsymbol{\gamma} + m_i + n_{it} \qquad (7),$$

where person i at time t earns wage w_{it}, and the error part in (6) is broken down into time-invariant error (m) and time-variant error (n). This transformation assumes that some personal characteristics like ability do not change over time. Therefore, by taking difference between earnings in various years, we are able to difference out unobserved but time-invariant personal characteristics. In this way, a fixed effect model can also recover unbiased estimates. Although this model has the potential to get unbiased estimation, it is not applied in this paper due to the lack of well-constructed panel data.

IV Data and Results

To test the predictions of specific human capital model requires considerably large amount of data that record every spell of trainings and training types. Using a non-US dataset to re-examine the theoretical model can be a valuable comparative study to validate the theory in a different economic context. The data used in this paper come from the "State and Life Chances in Urban China: 1949-1994" survey that was collected by Zhou and Moen (2002) under the sponsorship of the National Science Foundation.[1] It examined life chances among urban residents of China over time. Respondents aged 25-65 provided retrospective information concerning their education, work experience, political party membership, housing, family structure, and other social indicators. Detailed information was collected on the respondent's family background, including both parents' and grandparents' work and education experience, as many as 7 spells of formal schooling and job-training and their

[1] Zhou, Xueguang, and Phyllis Moen. *The State and Life Chances in Urban China, 1949-1994* [Computer file]. ICPSR version. Durham, NC: Duke University, Dept. of Sociology [producer], 2002. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2002. National Science Foundation grand number SBR 9413540.

respective starting and ending years, as many as 10 spells of working history with starting and end years and months, and industry sectors, job types and ranks, and other personal characteristic variables. Corresponding information was also collected on the respondent's spouse. A description of the key variables is given in table 1.

The most notable feature of this sample is the low training rate. Only less than 3 percent of the sample received on-job training, and 1.74 percent received off-job training. The corresponding percentage in the NLSY sample is between 10 and 20 percent. The small training percentage can be explained by the "iron rice-bowl" employment system that has been existing in China for a long time before the early 1990s. In such a system, people were assigned to various firms with little personal choice. Once a worker was employed, in most cases he had a promised job position till retirement. Turnover was minimal. The biggest problem with such a system is the lack of incentives to enhance productivity. On average, people in the sample had only 18 days of on-job training and 10 days of off-job training.

Other noticeable features include the significantly higher male wage than female wage, lower marriage rate among men than among women, less reported children and higher average education level for men than for women. In the sample, men are younger but have a much higher percentage of CCP party membership. CCP membership is a useful variable very special to China where CCP (China Communism Party) is the absolute ruling party and it members occupy important positions in every social sectors. Becoming a party member is challenging and such membership gives people an edge over non-members. In the male female comparison, it is also found that men are more likely to get training opportunities.

Comparing from another dimension, it is also found that trained people are also distinctively different from the total sample average. For instance, training people received much higher wages. They are less likely to be married with fewer children. While on-job trained people are just slightly better educated, off-job trained people have one more year of education than the whole sample average. Trained people have more experience, working in larger firms and having a much higher proportion of CCP members.

China is becoming more and more unequal ever since the start of economic reform in 1979. The Gini coefficient of year 2000 exceeded 30 and reached the level of the United States. Inequality in China, in turn, mainly derives from regional disparities. Table 2 examines this fact. As clearly shown, the average monthly wage in 1994 varied hugely across the eight sample provinces (and provincial-level cities). The richest province has an average wage amount almost 3 times as large as that of the poorest provinces. In fact, in the OLS analysis presented in Table 5, the inclusion of regional dummy variables doubled the model's explanatory power.

In order to examine the key determinants of getting training, two separate probits are presented in Table 3 on on-job training and off-job training. The number of children significantly lowers the possibility to access on-job training opportunities. As introduced in the background section, on-job training workers usually work almost full time in the firm. Therefore, on-job training elongates the working hours. Caring for children makes such training more inaccessible. Off-job training, on the other hand, gives workers a chance to study full time with no need to work at the firm. As a result, off-job training will decrease

household income but will not increase the total working load. Therefore, number of children has no significant impact on the likelihood of off-job training.

Other significant determinants of on-job training include health, experience and spouse's training experience. All the correlations are positive. Spouse's training also increases the chance of respondent's off-training likelihood. Although one hypothesis about couples is that the training of one person will require the other person to spend more time on housework and therefore may negatively relate to the training opportunity of the other person, another equally valid hypothesis is that training of a person may motivate efforts from his or her spouse and therefore the mutually supportive behavior between partners results in positive correlation between training likelihood of spouses. The data seem to support the latter hypothesis.

Besides using limited dependent variables on training, the amount of each type of training was also recovered from the survey data. The amount of training received generates more variance. Table 4 shows several OLS regression analyses on the determinants of the amount of training across types. Spouse training dummy variables consistently demonstrate positive impact on the amount of respondent training. Health is consistently important to on-job training, whether the training is in the current firm or throughout respondent's entire working history.

Table 5 shows some specifications of OLS regression about the determinants of logarithm of wages. This sample shows very little explanatory power of training variables. Specification ii shows that training variables only explains less than one percent of the total

variance in wages. Model iii combines the variables in model i and ii. Very tiny changes occurred in the coefficients, indicating that the training variables and other personal characteristic variables are hardly correlated. Health, experience, tenure at the current firm, gender and CCP membership remain significant. The training variables, though weak in explanatory strength, bear correct signs predicted by theories. Current training variables have mix influence on current wage level due to two facts: cost sharing and time needed to let training materialize into monetary rewards. Previous on-job training, viewed as mostly embodying firm-specific human capital, is irrelevant to the current firm and therefore creates no advantage for current wage level. Previous off-job training, with more general human capital, is portable and has significant positive impact on the wage level in the current firm. Such pattern of training variable coefficients is robust to all OLS specifications. The coefficient of previous off-job training lowered by very little with the inclusion of industry sector dummy variables (model iv). Even with the strongest predictor, regional dummy variable (model v), previous off-job remains significant and sustains a similar effect size. Training coefficients are also robust to clustered regression specification (model vi), with Huber-White standard errors calculated. The rationale for clustered regression is that even though we might control for regional disparities using dummy variables, the samples taken from the same regions may still share some unobserved features. Such unaccounted features are included in the error term, making the errors of those observations coming from the same region correlated, which violates the OLS assumptions. After testing on various OLS specifications, consistent pattern emerges that matches theoretical predictions very well[2].

[2] Another interesting pattern that is consistent across various models in Table 5 is the significant negative tenure-wage effect. There have been two predictions about tenure effect. One prediction is that people stayed longer in one firm are abler, or at least with a good matching. The other prediction states that people with longer tenure in one firm are less able people and that they stay just because they cannot find better offers in the labor market. The data from China seems to support the latter prediction. Indeed, in an

But before making any policy recommendations based on the above results, one important factor should be closely examined. That is, the endogeneity of training variables. Two types of adjustment were made to recover unbiased training effect. Table 6 presents a Heckman two-stage procedure. Column one shows a model without accounting for regional clustering problem and column two takes the problem into consideration and robust standard error was used. In both models, lambda, the selectivity variable is significantly related to wage levels in a negative way. Since by construction, lambda= f(Z'd)/F(Z'd) is less than zero. Therefore, a negative coefficient implies that the average income of training participants is higher than what the average income would have been if all the people got training. Similarly, the average income of non-trainees is higher than what the average income would have been if all the people did not participate in training. This result is a direct application of comparative advantage theory first described in the Roy model.

With significant selectivity coefficient, the adjusted training effect tends to zero. Only the party member coefficient remains significant, indicating the non-existence of a relationship between being a party member and potential abilities. Table 6 demonstrates that any training effect on wages might simply originate from some unobserved motivation and ability features. To make sure, Table 7 presents an IV regression model. The excluded instruments include spouse's on-job and off-job training spells at the current and previous firms, and the number of children. It is reasonable to assume that spouse's training and the number of children will affect the amount of respondent's training but have no impact on the wage levels. The Sargan test of such exclusion restrictions shows that those variables are

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employment system where turnover was rare, changing firms were costly. Only the best person can find a labor market advantage large enough to justify such turnover costs.

indeed excludable from the main wage equation. The IV regression method also presents no training effect on wages.

V. Discussions and Conclusion

The policy discussion on specific human capital versus general human capital is meaningful only when training can raise wages. If training effect largely derives from some unobserved motivation or ability features, then the Chinese government's policy of promoting job training misses the target. A better policy should be building a new incentive system that can motivate the workforce. But before rejecting training completely, the context in which the above results were generated should be re-examined.

First we need to consider the macro economic context in which the survey was completed. As introduced in the background section, with no complete labor market, wages are usually not representative of productivity. In fact, together with the rigid and seemingly equal wage system before the early 1990s, fringe benefits like bonus, subsidies and housing were more flexible. Considering wages together with housing conditions, for instance, can give a better description of the exact rewards to productivity. Housing was offered by firms to workers for free until recently. Housing conditions vary enormously. It can be a very helpful study in the future to incorporate housing quality into a reward index.

Secondly, the data set itself might lead to the failure of finding any training effect. The survey does not provide firm-side information. This is a very important drawback because although in the modeling of this paper training is completely regarded as a personal

choice, in reality training is also a firm choice, sometimes against personal wishes in the context of China. It is important to distinguish self-chosen training and firm-ordered training. As shown in the Heckman procedure, with free choice, people tend to choose such that their choice brings them the highest return. With firm-ordered training that is against personal will, that person cannot achieve his optimal efficiency. Mixing the above two types of training leads to undefined relationship between training and wages.

The accuracy of measurement is also a problem. For example, the training spell is only recorded on the yearly bases, while the firm seniority is recorded on monthly bases. Therefore, one month of training and 11 month of training might be both recorded as one year of training. In NLSY, training spells are measured so accurately to the weekly basis. The inaccuracy of measurement may leave no enough variance to allow for any significant wage-training correlation. Another accuracy problem is that the survey is a retrospective study. People were asked to recall the spells of various job market experiences till the survey year. Accuracy of people's memory is highly questionable. A third accuracy problem surrounds such variables as health. It is very likely that a manual laborer graded himself as healthy even though he is very tired because being tired is common to him. On the other hand, a pampered rich person may claim lots health problems even though he just got a little cut in his finger. Such variables are measured so subjectively that it is hardly reliable.

Having discussed all those possible improvements in future studies, it is still safe to conclude that if training indeed improves human capital and hence raises wages, which has been found true in competitive labor markets around the world, it is desirable for the Chinese government to direct resources to more general type of training rather than firm-

specific training. General training yields portable skills as well as some kind of credentials that can substantially reduce the cost of asymmetric information. But above these, the task for the government might be to build a healthy and competitive labor market first.

Appendix: Tables

Table 1--Sample Characteristics

Variables	All	Male	Female	on-job trained	off-job trained
Monthly Wage, 94	644.37	734.26	530.60	743.29	1165.15
Monthly Wage, 91	417.79	509.78	303.90	578.97	355.55
% Married	89.70	87.42	92.45	86.7	91.5
Children	1.68	1.53	1.85	1.55	1.56
School Years	11.35	11.74	10.89	11.53	12.38
Age, 1994	43.09	42.35	44.00	43.14	45.97
Experience (months)	300.7	294.26	308.27	310.21	325.15
% Party Member	23.14	30.70	14.40	29.63	35.56
Firm Size	1141.54	1717.16	1108.32	1590.52	1869.69
% On-job Training	2.95	3.69	2.11		
% Off-job Training	1.74	2.03	1.42		
On-job Training (Months)	0.60	0.73	0.46		
Off-job Training (Months)	0.35	0.43	0.27		
Sample Size	3491	2170	1321	104	60

Note:
1. Experience was not calculated by inferring from age and schooling years. Instead it was calculated by adding up all the spells of jobs that have been held till 1994. Therefore, it does not include unemployed periods.
2. The length of training spells was calculated using the starting and ending years of each spell. However, no monthly information is available. Some records show the same starting and ending year. For those cases, 9 months were assumed for the spell. Although it is also possible that cases with different beginning and ending years may start at the year end and stop in the beginning of next year, considering the fact that training during the year end holidays is rare, 12 months are assumed for each year difference.

Table 2 -- Regional Wage Disparities (unweighted)

Provincial Unit	Monthly Wage 1994	Sample Size
Beijing	795.9641	476
Hebei	473.3059	438
Helongjiang	330.1882	425
Shanghai	707.6765	408
Jiangsu	824.2596	492
Guangdong	917.4233	599
Sichuan	330.6628	436
Gansu	633.3288	438

Note: The average wage levels included in the table may not be representative of the urban regions in those provinces because only a few cities within each province were sampled. Those cities, based on the author's observation, are not representative cities of the provinces.

Table 3 -- Probits of The Probability of Receiving Training by Type

Variable	On-the-job Training	Off-the-job Training
Constant	-1.8235 (0.4067)**	-2.6800 (0.4454)**
Male	0.1879 (0.1179)	0.1614 (0.1424)
Party Member	0.1158 (0.1286)	0.0880 (0.1491)
# of Children	-0.1513 (0.0659)**	-0.1012 (0.0752)
Health	0.0643 (0.0292)**	0.0109 (0.0367)
Schooling	-0.0021 (0.0181)	0.0263 (0.0236)
Experience	0.0011 (0.0006)**	0.0010 (0.0007)
Spouse On-job Training	1.1516 (0.238)**	0.8482 (0.2926)**
Spouse Off-job Training	0.8004 (0.3017)**	0.7825 (0.3387)**
Industrial Sector Dummies	included	included
Log Likelihood	-277.62	-187.26
Sample Size	2452	

Note:
1. Standard errors in the parentheses; ** is significant at 5% level.
2. Industrial sectors consist of 6 groups: agricultural, service, raw material, production, research/education/arts and governmental organizations. No significance was found for industrial sector dummy variables.

Table 4 -- Determinants of the Amount of Trainings Received by Type and Spell

Variable	Months of All On-job Training	Months of All Off-job Training	Months of On-Job Training at Current Firm	Months of Off-job Training at Current Firm
Constant	1.3146	-0.0996	0.7504	-0.0642
	(0.5247)	(0.4415)	(0.2861)	(0.2558)
Male	0.2484*	0.1676	0.0013	0.1314*
	(0.1494)	(0.1257)	(0.0815)	(0.0729)
Married	-0.2626	0.2871	-0.1731	0.1658
	(0.3228)	(0.2716)	(0.1760)	(0.1573)
Party Member	0.1039	0.2363	-0.0235	-0.0145
	(0.1769)	(0.1488)	(0.0965)	(0.0863)
# of Children	-0.1477*	-0.0913	-0.0299	-0.0392
	(0.0774)	(0.0651)	(0.0422)	(0.0378)
Health	0.1013**	0.0275	0.0493**	-0.0001
	(0.0391)	(0.0329)	(0.0213)	(0.0191)
Schooling	-0.0115	0.0091	-0.0015	-0.0011
	(0.0226)	(0.0190)	(0.0123)	(0.0110)
Experience	0.0010	0.0006	-0.0001	0.0000
	(0.0007)	(0.0006)	(0.0004)	(0.0004)
Firm Size	1.63E-06	4.46E-07	-8.66E-07	1.94E-06
	(0.00001)	(9.21E-06)	(5.97E-06)	(5.33E-06)
Spouse On-job Train	3.5710**	1.4181**	0.5085**	0.4928*
	(0.5738)	(0.4828)	(0.3157)	(0.2822)
Spouse Off-job Train	2.0586**	2.0614**	1.0352**	2.4037**
	(0.6671)	(0.5613)	(0.3640)	(0.3253)
Previous On-job Train			0.0294**	-0.0073
(Months)			(0.0135)	(0.0121)
Previous Off-job Train			0.0003	-0.0045
(Months)			(0.0160)	(0.0143)
R-squared	0.0265	0.0142	0.0106	0.0256
Sample Size		2452		

Note: Standard errors in the parentheses. * significant at 10% level; ** significant at 5% level.

Table 5 -- Determinants of Log Wages of 1994

Variable	Specification					
	i	ii	iii	iv	v	vi†
Constant	5.1517**	5.9250**	5.1321**	5.0388**	4.9211**	5.1321**
	(0.1040)	(0.0129)	(0.1041)	(0.1227)	(0.0981)	(0.1866)
Tenure	-0.0005**		-0.0004**	-0.0004**	-0.0002	-0.0004**
	(0.0002)		(0.0002)	(0.0002)	(0.0001)	(0.0001)
Experience	0.0004**		0.0004**	0.0005**	0.0002	0.0004*
	(0.0002)		(0.0002)	(0.0002)	(0.0001)	(0.0002)
Schooling	0.0287**		0.0291**	0.0231**	0.0260**	0.0291**
	(0.0057)		(0.0057)	(0.0057)	(0.0053)	(0.0106)
Party Member	0.1344**		0.1302**	0.1079**	0.1907**	0.1302**
	(0.0382)		(0.0382)	(0.0393)	(0.0358)	(0.0502)
Health	0.0252**		0.0267**	0.0246**	0.0359**	0.0267*
	(0.0085)		(0.0085)	(0.0085)	(0.0080)	(0.0124)
Male	0.2628**		0.2606**	0.2837**	0.2731**	0.2606**
	(0.0318)		(0.0318)	(0.0320)	(0.0298)	(0.0663)
Current On-job Training (Months)		0.0132**	0.0119	0.0107	0.0018	0.0119
		(0.0042)	(0.0076)	(0.0075)	(0.0071)	(0.0101)
Current Off-job Training (Months)		0.0088	0.0024	-0.0004	-0.0009	0.0024
		(0.0071)	(0.0083)	(0.0083)	(0.0078)	(0.0066)
Previous On-job Training (Months)		0.0066*	0.0051	0.0055	0.0002	0.0051
		(0.0037)	(0.0051)	(0.0050)	(0.0048)	(0.0026)
Previous Off-job Training (Months)		0.0162**	0.0139**	0.0135**	0.0109**	0.0139*
		(0.0048)	(0.0060)	(0.0059)	(0.0056)	(0.0062)
Industry sector dummies	no	No	no	yes	no	No
East Region Dummy					0.5388**	
					(0.0307)	
R-Squared	0.0722	0.0072	0.0762	0.0913	0.1929	0.0762
Sample Size	2145	3712	2145	2145	2145	2145

Note: Standard errors in the parentheses. * significant at 10% level; ** significant at 5% level.
† Clustered regression with respect to provincial regions. Huber-White (robust) standard errors are included in the parentheses.

Table 6 -- Heckman Two Stages Procedure Corrects for Endogeneity

Variable	Specification	
	without Clustering	Clustering on Province
Constant	8.4661	8.8332
	(0.5751)	(0.6143)
Tenure at current Firm	0.0007	0.0002
	(0.0006)	(0.0004)
Experience	0.0001	-0.0002
	(0.0005)	(0.0008)
Schooling	-0.0122	0.0002
	(0.0181)	(0.0133)
Party Member	0.2304**	0.1788
	(0.1121)	(0.2385)
Health	-0.0021	-0.0634
	(0.0367)	(0.0377)
Male	0.0663	-0.0648
	(0.1173)	(0.0743)
Previous On-job Training	-0.0066	-0.0066**
(Months)	(0.0043)	(0.0024)
Previous Off-job	0.0113	0.0046
Training (Months)	(0.0114)	(0.0156)
lambda (selectivity variable)	-1.0840**	-0.8808**
	(0.2851)	(0.3229)
log likelihood	-332.267	-340.2085
LR test of indep. eqns.	chi2(1)=11.28**	chi2(1)=16.50
Wald chi2	29.42**	—
Observations	3870	3870

Note:
1. Selectivity variable = f(Z'd)/[1-F(Z'd)], where f and F are pdf and cdf respectively. Z is a vector of explanatory variables of the first stage choice equation. It includes: number of children, and lengths of spouse's on and off-the-job training experiences.
2. Robust standard errors were calculated for the clustering specification.
3. Standard errors in the parentheses. * significant at 10% level; ** significant at 5% level.

Table 7 -- Instrument Variables Correct for Endogeneity

Variable	coefficient	standard error
Constant	4.5862	0.4201
Tenure at current Firm	0.0002	0.0042
Experience	0.0001	0.0005
Schooling	0.0314**	0.0106
Party Member	0.1271	0.0823
Health	0.0645*	0.0387
Male	0.2616**	0.0549
East Region	0.3258	0.2573
Current On-job Training (Months)	0.4336	0.7141
Current Off-job Training (Months)	-0.0442	0.1037
Previous On-job Training (Months)	0.0651	0.0658
Previous Off-job Training (Months)	0.1308	0.1705
observations	2079	
Sargan Statistic	0.677 (Chi2 p-value = 0.411)	

Note:
1. Standard errors in the parentheses. * significant at 10% level; ** significant at 5% level.
2. Excluded instruments are spouse's on and off-the-job training lengths at current period, spouse's on and off-the-job training lengths at previous period, and the number of children.

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